To Observe Change of State and Plot a Cooling Curve for Molten Wax

Aim

To observe change of state and plot a cooling curve for molten wax.

Apparatus

A uniform straight wooden metre rod (scale). Two G clamp, pointer pin, thread, slotted weights of 50 g each, wax, vertical scale, clamp stand.

Theory

(a) For cooling

The depression (Buckling) δ produced in the wooden rod of length l.

$$\delta = \frac{mgl^3}{4Y\,bd^3}$$

m = Total mass of slotted weights
Y = Young modulus
b = breadth
d = depth

For a given rod, $\delta \propto mg$

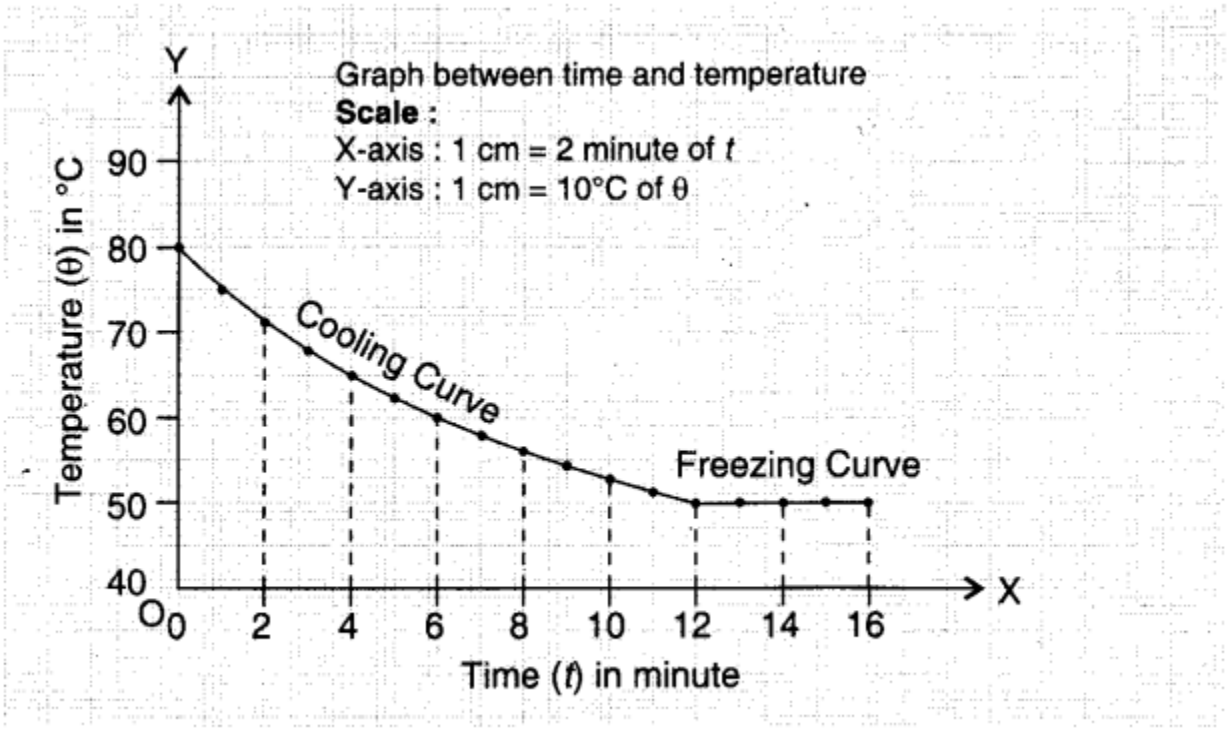
***i.e.*, the depression produced is directly proportional to the load (weight) suspended from one end.**

(b) For change of state

When molten wax cools down to its freezing point, it starts solidifying and the temperature becomes constant.

The curve becomes horizontal thereafter (parallel to time-axis) as shown in Graph.

Graph



Graph between time (t) and temperature (θ).

Procedure

Steps 1 to 8 of experiment 6 except step 2 in which calorimeter is filled two third by molten wax (in place of water)

9. When temperature of wax falls to about 80°C note it and start the stop clock.
10. Continue stirring and note temperature after every one minute.
11. Note enclosure water temperature after every five minutes.
12. When fall of temperature stops, remove the lid and note that the wax in calorimeter starts solidifying. Temperature remains same till all the wax in calorimeter solidifies.
13. Watch the constant temperature for some minutes.
14. Record your observations as given below.

Observations

Least count of enclosure thermometer = …….°C.
Constant temperature of enclosure, θ_0 = …….°C
Least count of calorimeter-wax thermometer = ……°C.
Least count of stop clock/watch = ……..s.

Table for time and temperature

Serial No. of Obs.	*Time for cooling t(mt)*	*Temperature of wax in calorimeter θ (°C)*
1.	0	80
2.	1	76
3.	2	72
4.	3	69
5.	4	66
6.	5	63
7.	6	61
8.	7	59
9.	8	57
10.	9	55
11.	10	53
12.	12	50
13.	14	50
14.	16	50
15.	18	50
16.	20	50

(**Note.** *The ideal observations given above are as sample.*)

Plot a graph between time t and temperature 0, taking t along X-axis and 0 along Y-axis. The decreasing slope curve is called cooling curve of molten wax.
The horizontal straight line is called freezing curve of the wax.

Result

1. The temperature falls quickly in the beginning and then slowly.
2. When wax starts freezing, the temperature does not fall further. The freezing point comes to be 50°C as calculated from graph.

Precautions

1. The metre scale should be straight and uniform and clamped firmly.
2. The tip of pointer should not touch the vertical scale.
3. The scale should not be loaded beyond the elastic limit.
4. Reading on metre scale should be taken carefully.

Sources of error

1. The metre scale may be non-uniform.
2. The tip of pointer may not be very sharp.